beomaster 5000

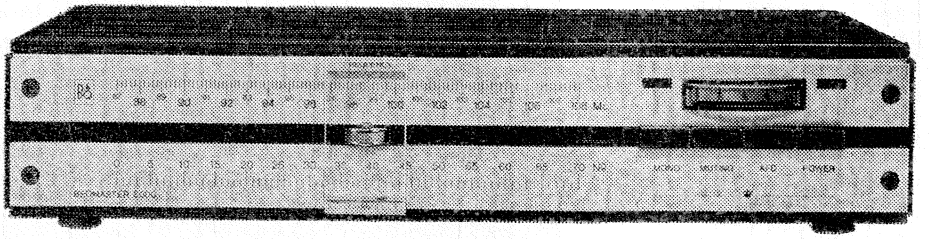
types 2005, 2012 and 2013

also TEENA 610 FM

SERVICE MANUAL

BANG & OLUFSEN A/S LEVERANDØR TIL DET KONGELIGE DANSKE HOF

Det danske kvalitetsmærke



BANG & OLUFSEN A/S

STRUER-DENMARK Telephone (07) 85 11 22* - Telex 4289 - Cable Address Bangoluf

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TECHNICAL DATA FOR THE BEOMASTER 5000

DIMENSIONS AND WEIGHT

Dimensions: 470 mm wide, 100 mm high, 250 mm deep
(18.1/2" x 3.15/16" x 9.7/8")
Weight: 6 Kg. (13.2 lb)

POWER SUPPLY

Voltage: 110-130-220 and 240 volts AC
Frequency: 50/60 c/s.
Power Consumption: 12 watts

CONNECTIONS

Inputs: Aerial, 75 and 300 Ω and monitor
Outputs: RCA or DIN socket for amplifier
Output level adjustable from 55 mV to 1 V for 75 Kc/s swing.
DIN socket for tape recorder
Output level: 100 mV for 75 Kc/s swing.

TUNING

Tuning range: 87-108 Mc/s.
Sensitivity: 0.8 µV for 20 dB signal-to-noise ratio
Intermediate frequency: 10.7 Mc/s. IF bandwidth: 3dB 300 Kc/s.
Detector bandwidth: 1 Mc/s.
Signal frequency circuits: 4 tuned circuits and separate oscillator.
Tuning: 4 gang variable capacitor.

MULTIPLEX ADAPTOR

Channel separation: 40 dB at 1 Kc/s
Distortion: 1000 c/s, 40 Kc/s swing, 100 µV: 0.4%
Residual pilot and carrier signal: < 50 dB
Frequency response: 20 c/s - 15 Kc/s. Stereo/mono: ±2 dB

SEMICONDUCTORS AND TUNED CIRCUITS

22 transistors
20 diodes
25 tuned circuits.

SPECIAL FEATURES

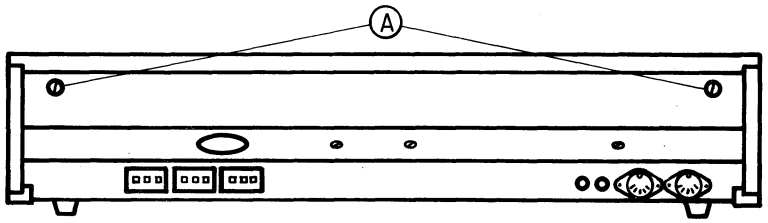
AFC (automatic frequency control)
Automatic stereo/mono switching. Switching level is adjustable for signal strengths between 1 and 100 µV.
Muting (removes inter-station hiss) Muting level is adjustable for signal strengths between 0.5 and 40 µV.
Precision tuning meter.
Stereo indicator for visual identification of stereo broadcasting.

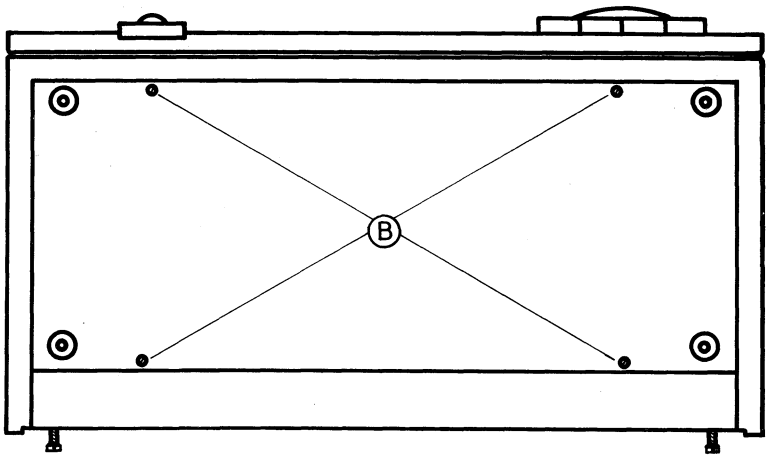
Subject to alteration without notice.

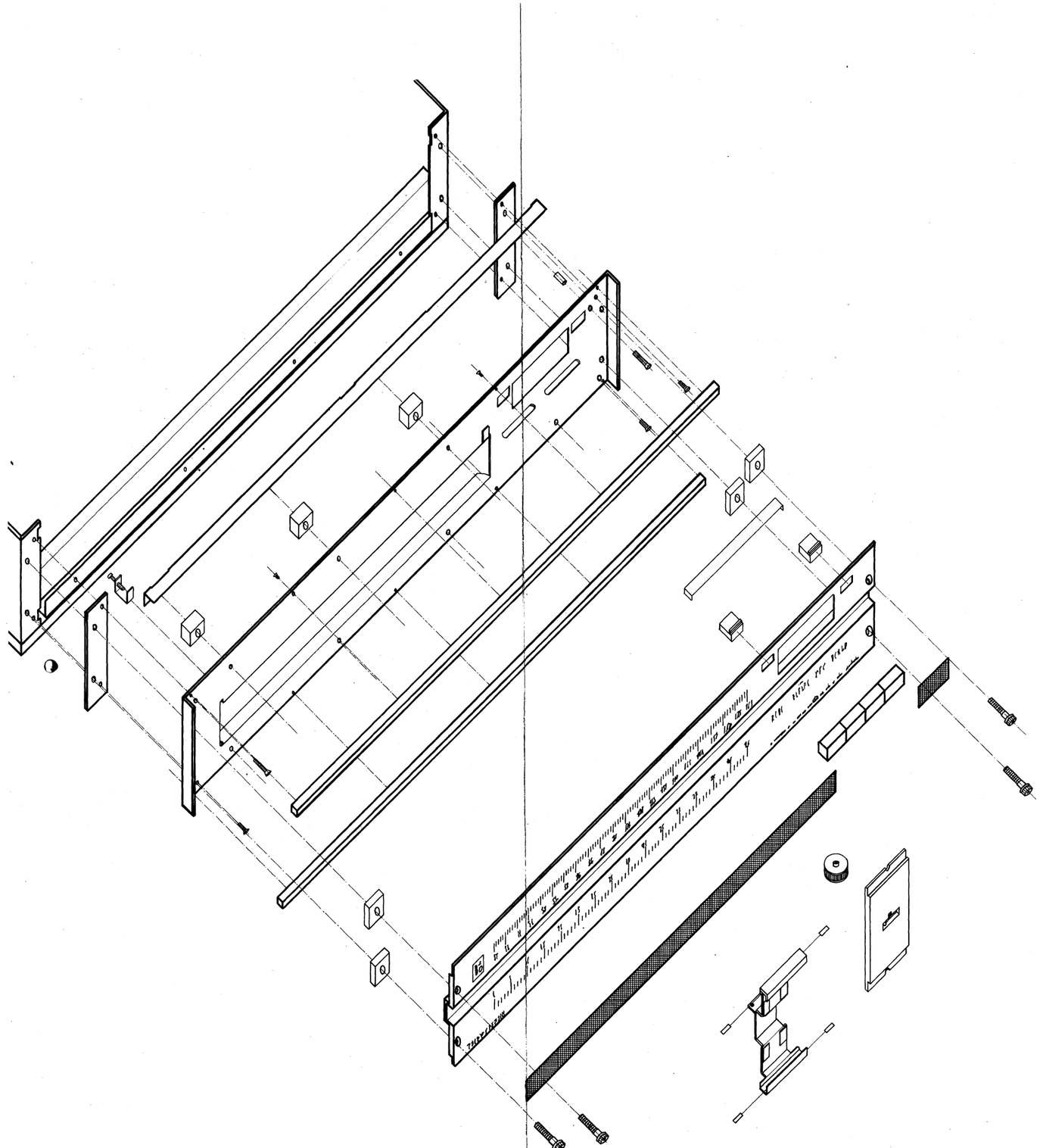
Disassembling the Cabinet

To remove the top section of the cabinet, first unscrew screws A, then tilt the top section upwards at the rear and pull backwards (Screws A cannot be removed).

To remove the bottom plate, unscrew screws B.

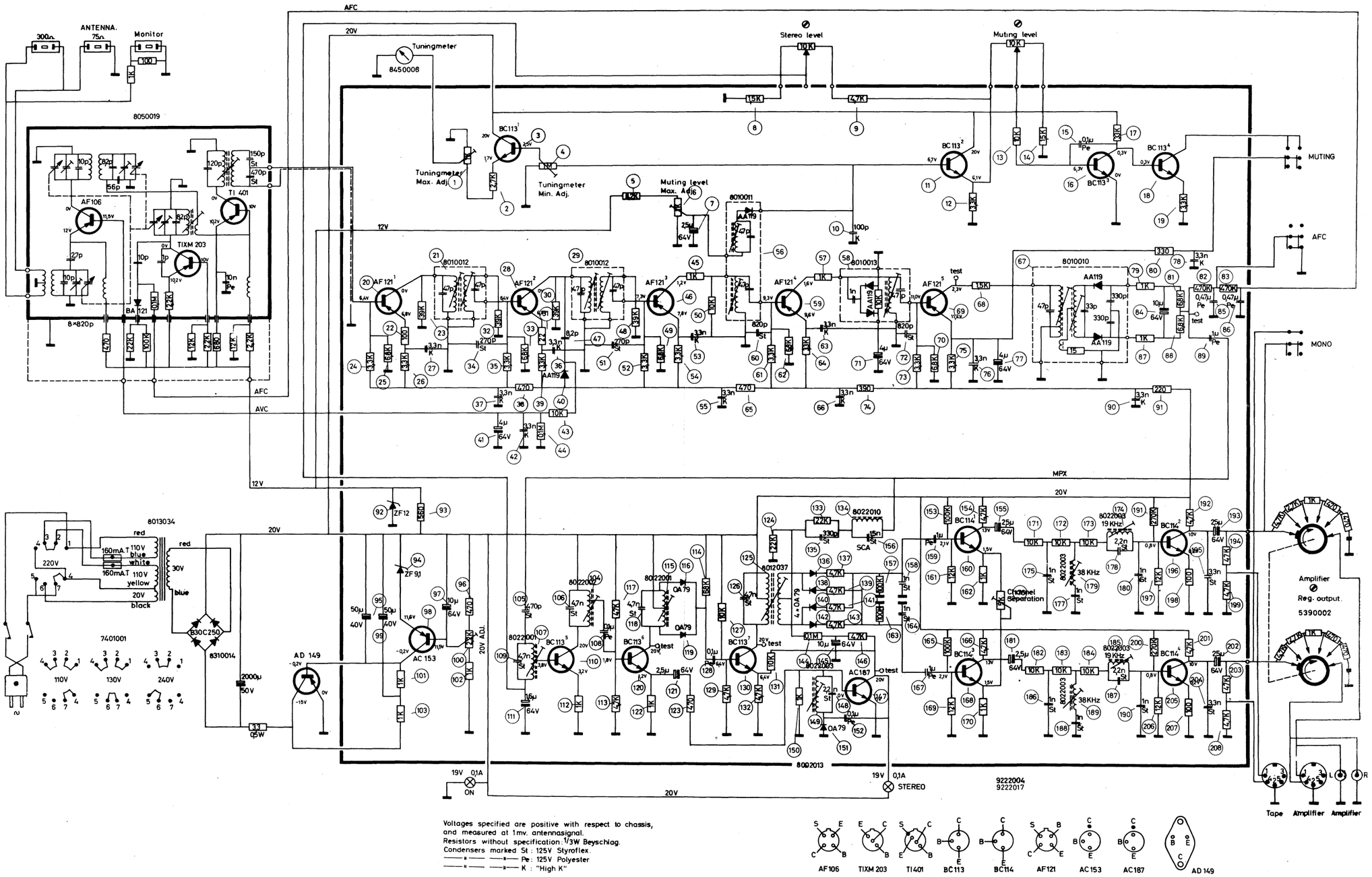






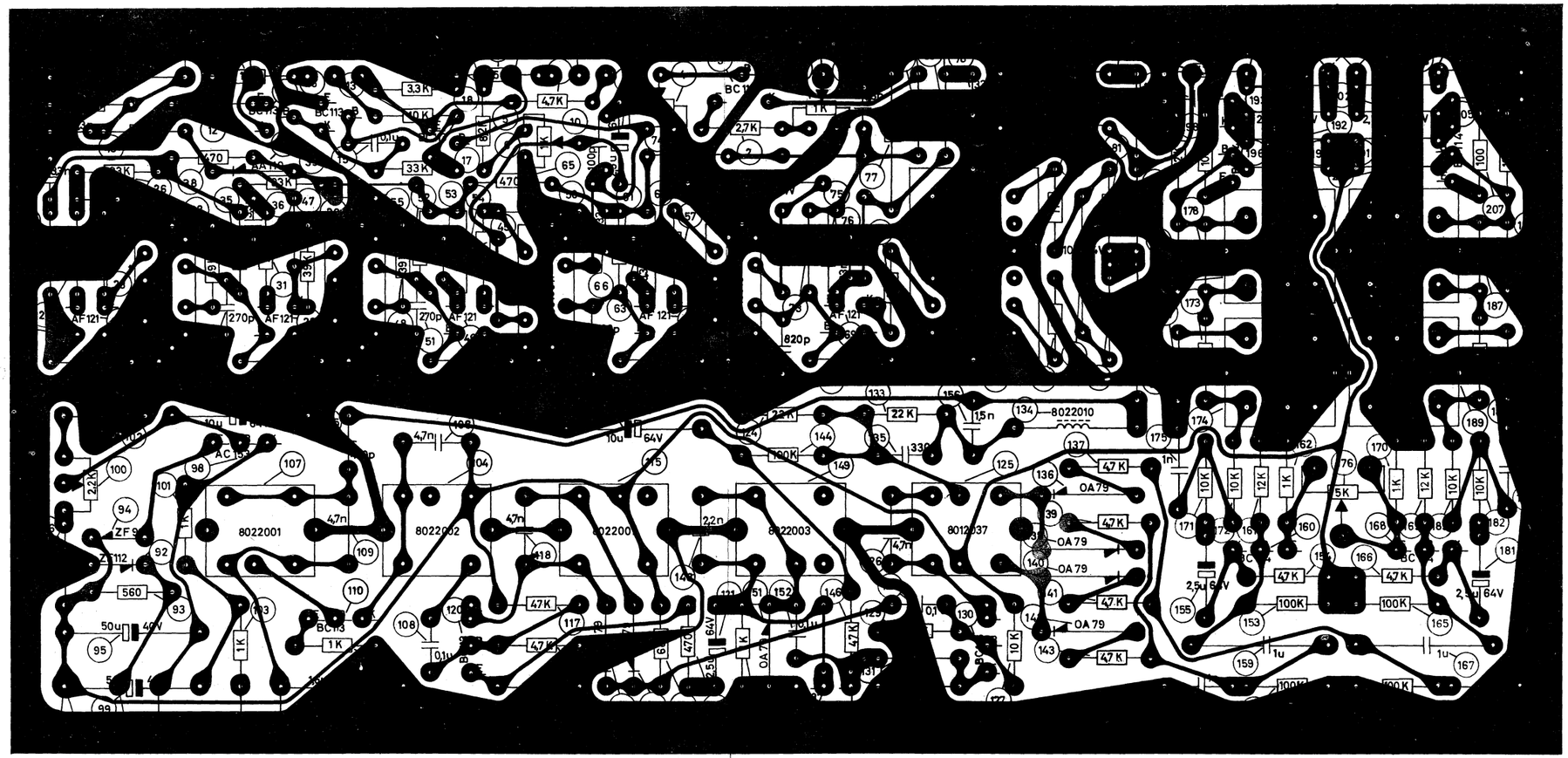
The front panel, together with its controls, consists of many mechanical parts and is therefore shown disassembled above.

CIRCUIT DIAGRAM OF BEOMASTER 5000, TYPE 2005



Voltages specified are positive with respect to chassis, and measured at 1mv. antennasignal.
Resistors without specification: 1/3W Beyschlag.
Condensers marked St : 125V Styroflex.
——"—— ——"—— Pe : 125V Polyester
——"—— ——"—— K : "High K"

PW UNIT 8002013



Ledningsfarver — Colour of wires — Kabelfarben

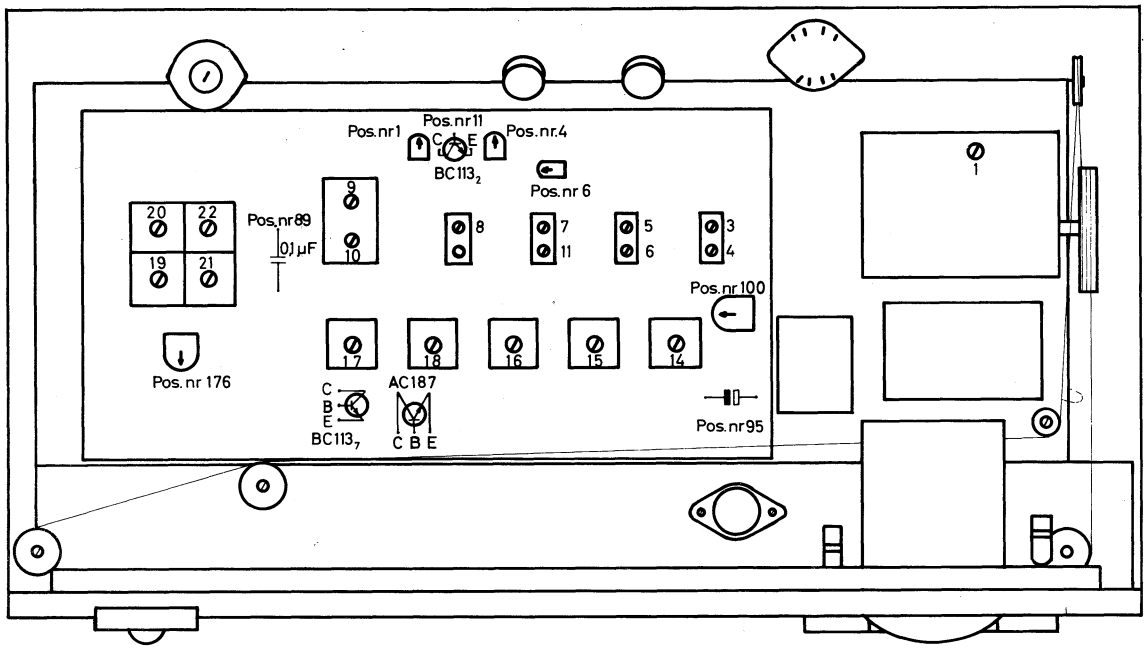
bl:	blå	— blue	— blau
br:	brun	— brown	— braun
g:	gul	— yellow	— gelb
gr:	grøn	— green	— grün
grå:	grå	— grey	— grau
hv:	hvid	— white	— weiss
or:	orange	— orange	— orange
r:	rød	— red	— rot
s:	sort	— black	— schwarz
v:	violet	— violet	— violett

ALIGNMENT AND ADJUSTMENT CHART

Nature of measurement and adjustment	Dial Setting	RF connection	Instrument	Instrument connection	Frequency	Adjustment	Remarks	Adjust for
20 V stab.			Voltmeter	+ of 50 µF, Part No. 95		2.2 KΩ, No. 100	Adjust very carefully	20 V
IF alignment		aerial input	sweep/oscilloscope	+ Base BC 113 2 No. 111	10.7 Mc/s	Coils 1, 2, 3, 4, 5, 6 and 7	*RC probe **300 Kc/s 6 dB	**max. response and sym. curve
		aerial input	sweep/oscilloscope	*test at No. 89	10.7 Mc/s	Coils 8, 9 and 10	*RC probe **1 Mc/s	**max. response and sym. S-curve
	100 Mc/s	aerial input	signal generator / voltmeter	test at No. 89	100 Mc/s	Re-adjust coil 10	Adjust very carefully	0 volts.
			voltmeter	test at No. 89			Must not deviate from 0 V when set is not tuned to a station.	
	100 Mc/s	aerial input	signal generator/ output meter	amplifier output	100 Mc/s	Re-adjust coils 1-9	Input 3 dB below limiting level. Check 0 volts during alignment.	max. output
Coupling circuit	100 Mc/s	aerial input	signal generator	tuning meter	100 Mc/s	Coil 11	Weak input signal. 0 volts and max. output should coincide in centre of tuning range.	max. deflection.
Muting						1 KΩ No. 6	Depress 'Muting' button; 'Stereo Level' and 'Muting Level' at max. (no signal).	Adjust until hiss disappears.
Osc. alignment	89 Mc/s	aerial input	signal generator/ output meter	amplifier output	89 Mc/s	Coil 12		max. signal
	106 Mc/s	aerial input	signal generator/ output meter	amplifier output	106 Mc/s	Trimmer 13		max. signal
MPX Light		*aerial input	signal generator/ oscilloscope	collector AC 187		Coil 18	*stereo signal (pilot frequency, 19 Kc/s)	max. clipping
MPX		*aerial input	signal generator/ oscilloscope	collector BC 113 7		Coils 14, 15, 16 and 17	*stereo signal (pilot frequency, 19 Kc/s)	max. signal (38 Kc/s)
Channel separation		*aerial input	signal generator/ output meter	amplifier output L		5 KΩ, No. 176	*stereo signal, modulated R channel	min. in L channel
		*aerial input	signal generator/ output meter	amplifier output R		Re-adjust No. 176	*stereo signal, modulated L channel.	min. in R channel
Parallel and Series traps		*aerial input	signal generator/ output meter	amplifier output L		Coils 19 and 20	*unmodulated stereo signal	min. output meter reading.
		*aerial input	signal generator/ output meter	amplifier output R		Coils 21 and 22	*unmodulated stereo signal	min. output meter reading.
Tuning meter						1 MΩ, No. 4	No signal	zero reading
	100 Mc/s	*aerial input	signal generator		100 Mc/s	1 KΩ, No. 1	*unmodulated signal (200 V)	full-scale reading

Sweep generator: Frequency swing, approx. 1 Mc/s

Signal generator: Frequency swing, 75 Kc/s.


Pos.nr1
Pos.nr11
Pos.nr.4
BC113₂
Pos.nr 6
Pos.nr89
0,1 µF
Pos.nr100
Pos. nr 176
AC187
BC113₇
Pos.nr95
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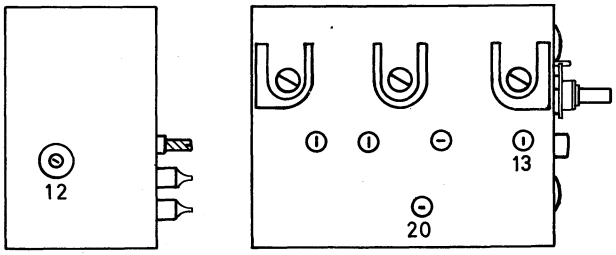
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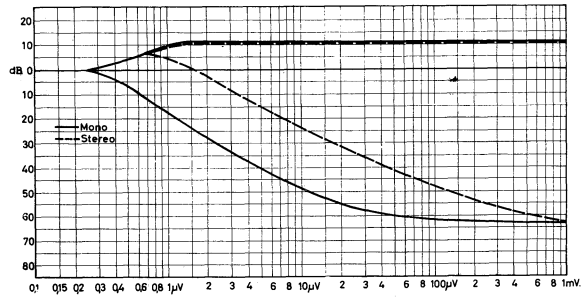
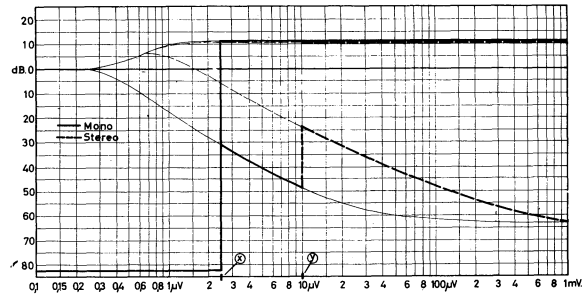
13
20

SENSITIVITIES

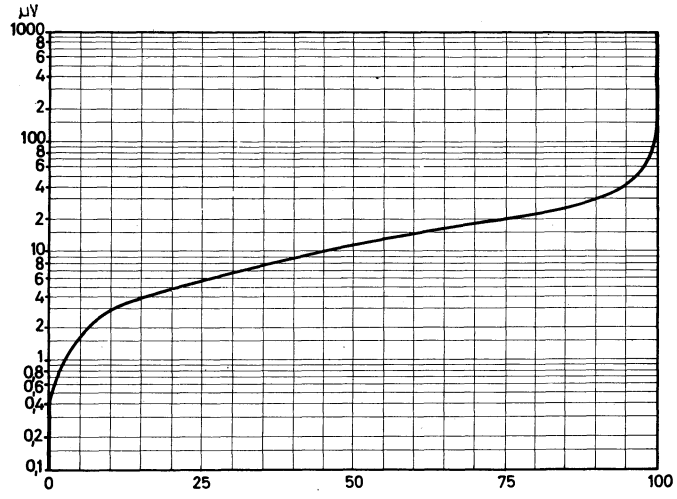
Aerial Input	Remarks	Signal-to-Noise Ratio
0.5 µV	Min. limit of muting function	
1 µV	Mono signal	25 dB
1 µV	Min. limit of automatic stereo/mono switching circuit	5 dB
2.5 µV	Muting starts to function (factory adj)	
5 µV	Tuning meter deflects to first graduation mark	
10 µV	Automatic stereo/mono switching circuit starts to function (factory adj)	
10 µV	Tuning meter deflects to approx. 50	
10 µV	Mono signal	approx. 60 dB
10 µV	Stereo signal	approx. 35 dB
40 µV	Max. limit of muting function	
40 µV	Mono signal	approx. 70 dB
40 µV	Stereo signal	approx. 50 dB
100 µV	Max. limit of automatic stereo/mono switching circuit.	
100 µV	Mono signal	approx. 70 dB
100 µV	Stereo signal	approx. 70 dB
1 mV	Stereo signal	approx. 70 dB



Signal and noise curves, mono and stereo, as functions of the incoming signal voltage.



Muting and stereo control circuit curves



TUNING

Plot of incoming signal voltage as a function of tuning meter reading.

DESCRIPTION

RF Front End

The aerial circuit has inputs for 300Ω balanced and 75Ω unbalanced and a monitor input which is attenuated by a factor of approx. 40 dB to allow for powerful local stations. Three tuned signal-frequency circuits ahead of the mixer ensure a high order of selectivity. The tuning capacitor has four sections. One of these tunes the input circuit whilst the second and third tune band pass coupled coils between the AF 106 RF amplifier stage and the TI 401 mixer stage. In order to avoid frequency shifts and repeat spots, the mixer stage receives constant voltage from a separate oscillator, TIXM 203. A BA 121 diode is used in the AFC circuit.

IF Amplifier

The IF amplifier has five stages at 10.7 Mc/s and uses five AF 121's In order to minimise phase shift and distortion on stereo signals, the IF band width is 300 Kc/s whilst the detector has a band width of 1 Mc/s. The tuner receives AVC bias from the AA 119 diode in the second IF amplifier stage. The third IF amplifier stage incorporates a rectifier which is inductively coupled to the third IF transformer. This rectifier provides control voltage for the tuning meter and the muting circuits. The fourth IF amplifier stage comprises the AM limiter, consisting of two AA 119 diodes which provide approx. 52 dB of suppression at 100μV. The output of the ratio detector, two AA 119's, provide AFC control bias for the front end and audio signal for the multiplex adaptor.

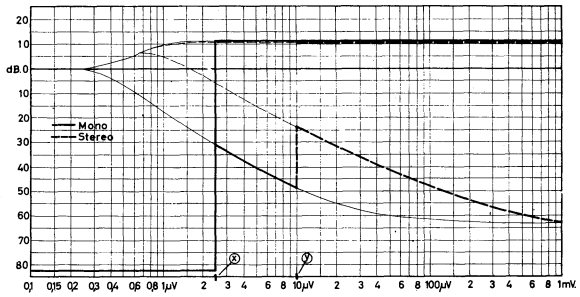
Tuning Adaptor

The above mentioned rectifier in the third IF amplifier stage, 8010011, provides control voltage for the meter. This voltage moves in the positive direction at increasing aerial signal: an emitter follower, BC 113_1, has been incorporated at this point in order to avoid rectifier overloading. Taking off the meter control voltage in the third IF amplifier stage has two advantages: precise tuning indication is obtained and the meter may be used as a field strength indicator until the receiver has reached its total signal-to-noise ratio of 75 dB.

Muting (noiseless tuning)

The muting circuit determines when the receiver IF amplifier will pass an incoming signal, depending on a pre-set signal level.

Just like the tuning meter circuit, the muting circuit receives its control voltage from detector 8010011. This DC bias voltage moves in the positive direction at increasing aerial voltage. The bias voltage is applied to the base of emitter follower BC 113_2, which is followed by two DC amplifiers, BC 113_3 and BC 113_4. A control facility for muting level adjustment is inserted between the emitter of BC 113_2 and the base of BC 113_3. The two DC amplifiers, BC 113_3 and BC 113_4, operate as follows: At weak signal levels and at no signal, current flows through BC 113_3 and BC 113_4, causing the emitter voltage at AF 121_5 to exceed the base voltage. No collector current flows and the path of the IF signal is therefore blocked.



These curves illustrate the operation of the factory pre-adjusted muting and stereo/mono switching circuits.
Tracing the solid curve, it will be seen that until the aerial signal voltage reaches 2.5 µV (point X), hiss and noise are suppressed by a factor of approx. 85 dB: at this point the muting circuit operates and the receiver will begin to play since an acceptable signal-to-noise ratio of approx. 40 dB has now been reached. If the programme received had been a stereo broadcast, the stereo/mono switching circuit would have prevented the receiver from switching to stereo owing to the poor signal-to-noise ratio of stereo transmissions. In this case the signal-to-noise ratio would be only approx. 16 dB for an aerial signal voltage of 2.5 µV. Only at 10 µV, point Y, does the receiver switch to stereo, the signal-to-noise ratio being now approx. 35 dB.
The areas indicated by arrows denote the areas in which the X and Y operating points can be shifted by means of the Muting Level and Stereo Level controls respectively.

Stereo Level

Control voltage for the base of the first transistor, BC 113_5, of the multiplex adaptor is taken off the emitter follower used for the muting circuit, via a divider comprising one variable resistor (the Stereo Level control).

If the signal level goes below a certain limit determined by the Stereo Level potentiometer, BC 113_5 in the multiplex adaptor will cut off so that no drive will be applied to the ring modulator and the signal will be reproduced as a mono signal; in other words, the receiver will automatically switch to mono when the signal is too weak for acceptable stereo reproduction (see curve).

Because the receiver signal-to-noise ratio is reduced by a factor of approx. 22 dB by the changeover from mono to stereo, the aerial signal required for reception of a stereo signal at the same signal-to-noise ratio as a mono signal is between four and ten times stronger.

Decoding

The stereo signal is now fed to the input of the multiplex adaptor, where the 19 Kc/s signal is separated and doubled to 38 Kc/s in three tuned circuits. The purpose of the 38 Kc/s signal is to restore the carrier to the stereo signal, which is passed to the centre tap of the ring modulator secondly through an SCA filter (67 Kc/s) and a de-emphasis network. The left and right channels are restored in the ring modulator and are then fed through a channel separator with a BC 114 in either channel and ensures maximum channel separation - approx. 40 dB at 1 Kc/s.

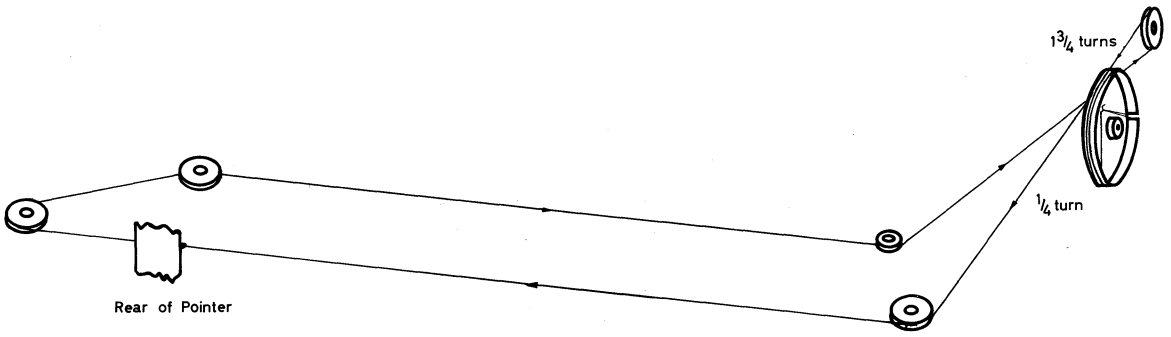
Two traps prevent any residual 19 Kc/s and 38 Kc/s signals from reaching the audio amplifier. The 19 Kc/s trap is of the parallel resonant type while a series trap is used for 38 Kc/s signals. The following audio amplifier provides an output level of 1 volt, adjustable with the 5 position Output Level control.

Stereo Indicator

A 19 Kc/s signal taken from the emitter of BC 113_6 is fed to a diode circuit comprising a coil tuned to 19 Kc/s. The voltage building up across the 1 KΩ diode leak resistor will cause the AC 187 transistor to draw current and the filament lamp (stereo indicator) in the collector circuit of the AC 187 to light up.

Power Supply Section

A stabilised power supply is used in order to provide a constant and effectively filtered 20 volt potential. Series transistor AD 149 in the chassis lead is controlled by ZF 9.1 and AC 153. A 2.2 KΩ potentiometer in the base circuit of the AC 153 permits adjustment of the 20 volt potential, which is measured between the AD 149 emitter (chassis) and the cathode of the ZF 9.1 diode.

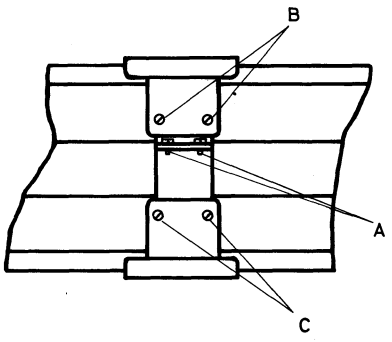


Dial Cord Replacement

Following replacement of the dial cord, the pointer should be secured as follows:

Push the slide pointer against the stop at 87 Mc/s. Pull the dial cord to rotate the tuning capacitor shaft as far as it will go (plates fully meshed). Then pull the dial cord 12 mm away from the fully meshed setting and secure it to the slide pointer by means of screws A.

The pointer travel is approx. 24 mm shorter than the cord travel in order to protect the mechanical stop of the tuning capacitor.

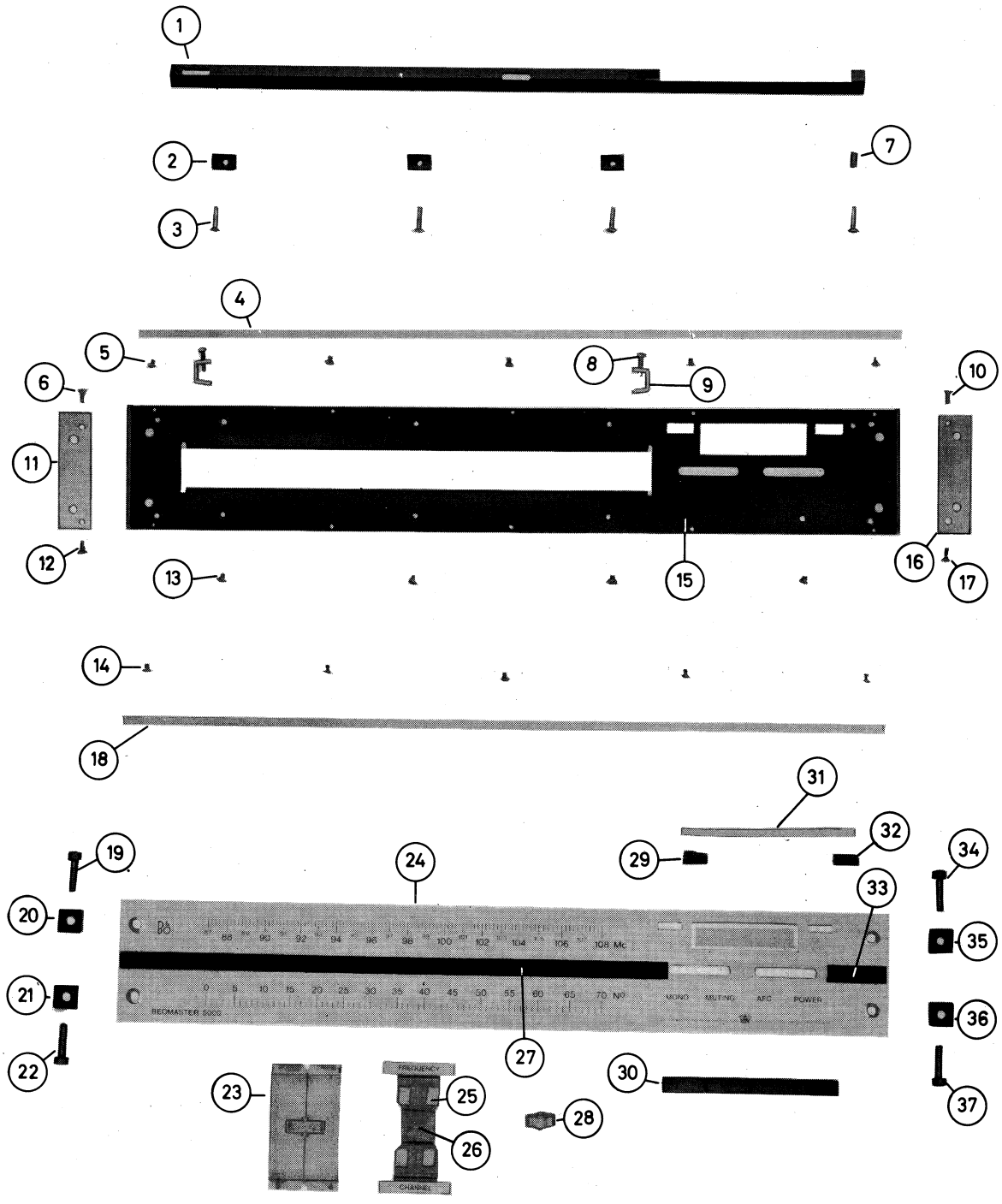


Slide Pointer Adjustment

Loosen screws A and remove the dial cord from the pointer. Now disassemble the front moulding and adjust screws B and C so that the pointer slides smoothly and without backlash. Mount the moulding and fix the pointer to the dial cord as described under dial cord replacement above.

PARTS LIST, BEOMASTER 5000

1	Bracket	0245728
2	Spacer	0285092
3	Screw, AM 3 x 15 DIN 63	2038023 - 4 off
4	Edging	0280496
5	Screw, AM 2 x 4 DIN 63 MS	2034001 - 5 off
6	Screw, AM 3 x 8 DIN 63	2038009
7	Distance pipe	0430178
8	Screw, AM 3 x 12 DIN 84	2038220
9	Stop clamp	2510028
10	Screw, AM 3 x 8 DIN 63	2038009
11	Spacer	0287216
12	Screw, AM 3 x 8 DIN 63	2038009
13	Screw, AM 3 x 4 DIN 63	2038003 - 4 off
14	Screw, AM 2 x 4 DIN 63	2034001 - 5 off
15	Front panel	0540794
16	Spacer	0287216
17	Screw, AM 3 x 8 DIN 63	2038009
18	Bar	0280496
19	Screw, hexagonal socket head, M 5 x 20 MC	2044904
20	Spacer	0285093
21	Spacer	0285093
22	Screw, hexagonal socket head, M 5 x 20 MC	2044904
23	Pointer	3190007
24	Front moulding	0283058
25	Felt for spring, 7 x 10 mm	3912020
26	Slide	0283062
	Bronze springs for slide	2815002
	Rivet for spring	2364001
	Felt for slide, 3 x 10 mm	3912021
	Pointed screw, M 3 x 3 DIN 438	2072700
	Clamp for dial cord	0287177
	Screw for clamp, A 2 x 4 DIN 84	2034231
27	Rubber strip	0283060
	Pansor glue	RPM2857
28	Roll	0373076
29	Plate, Stereo	3183001
30	Pushbutton	0322345
31	Screen	3302013
32	Plate, ON	3183002
33	Tape, black	3947433
34	Screw, hexagonal socket head, M 5 x 20 MC	2044904
35	Spacer	0285093
36	Spacer	0285093
37	Screw, hexagonal socket head, M 5 x 20 MC	2044904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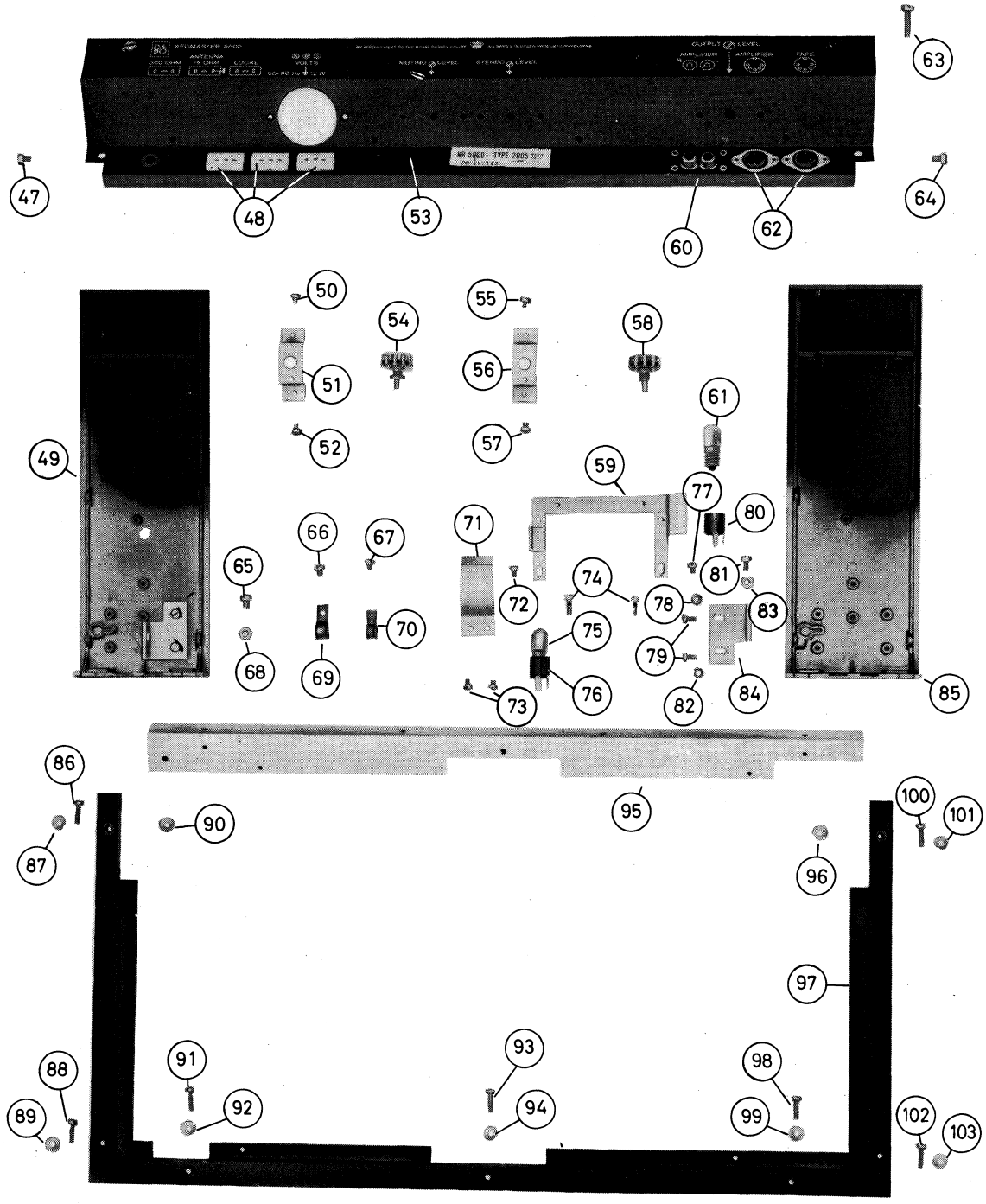
FREQUENCY
CHANNEL

47	Screw, AM 4 x 6 DIN 84	2042205
48	Aerial input socket	7211026
49	Side wall	0540781
50	Screw, AM 3 x 4 DIN 84	2038206
51	Bracket	0240328
52	Screw, AM 3 x 4 DIN 84	2038206
53	Rear wall	0249301
54	Potentiometer, 10 KΩ KV 1	5300013
55	Screw, AM 3 x 4 DIN 84	2038206
56	Bracket	0240328
57	Screw, AM 3 x 4 DIN 84	2038206
58	Potentiometer, 10 KΩ KV 1	5300013
59	Bracket for tuning meter	0245753
60	Socket	7219004
61	Dial lamp, 19 V/0.097 A, 8097 D/71	8230004
62	5 contact DIN jack plug	7212007
63	Screw, AM 4 x 16 DIN 84	2042216
64	Screw, AM 4 x 6 DIN 84	2042205
65	Screw, AM 4 x 6 DIN 84	2042205
66	Screw, AM 3 x 4 DIN 84	2038206
67	Screw, AM 3 x 4 DIN 84	2038206
68	Nut, 4 MT	2380016
69	Cable clamp	2515005
70	Cable clamp	2515003
71	Mounting clamp	0240327
72	Screw, AM 3 x 4 DIN 84	2038206
73	Screw, AM 3 x 4 DIN 84	2038206
74	Screw, AM 3 x 10 DIN 84	2038216
75	Dial lamp, 19 V/0.097 A, 8097 D/71	8230004
76	Socket for dial lamp	7201002
77	Screw, AM 3 x 4 DIN 84	2038206
78	Tooth lock washer	2625002
79	Screw, AM 3 x 6 DIN 84	2038247
80	Socket for dial lamp	7201002
81	Screw, AM 4 x 6 DIN 84	2042205
82	Tooth lock washer	2625002
83	Nut, 4 MT	2380016
84	Bracket	0245732
85	Side wall	0540781
86	Screw, AM 3 x 12 DIN 84	2038220
87	Washer	2622016
88	Screw, AM 3 x 12 DIN 84	2038220
89	Washer	2622016
90	Washer	2622016
91	Screw, AM 3 x 12 DIN 84	2038220
92	Washer	2622016
93	Screw, AM 3 x 12 DIN 84	2038220
94	Washer	9622016
95	Bracket	0245729
96	Washer	2622016
97	Bottom frame	0542440
98	Screw, AM 3 x 12 DIN 84	2038220
99	Washer	2622016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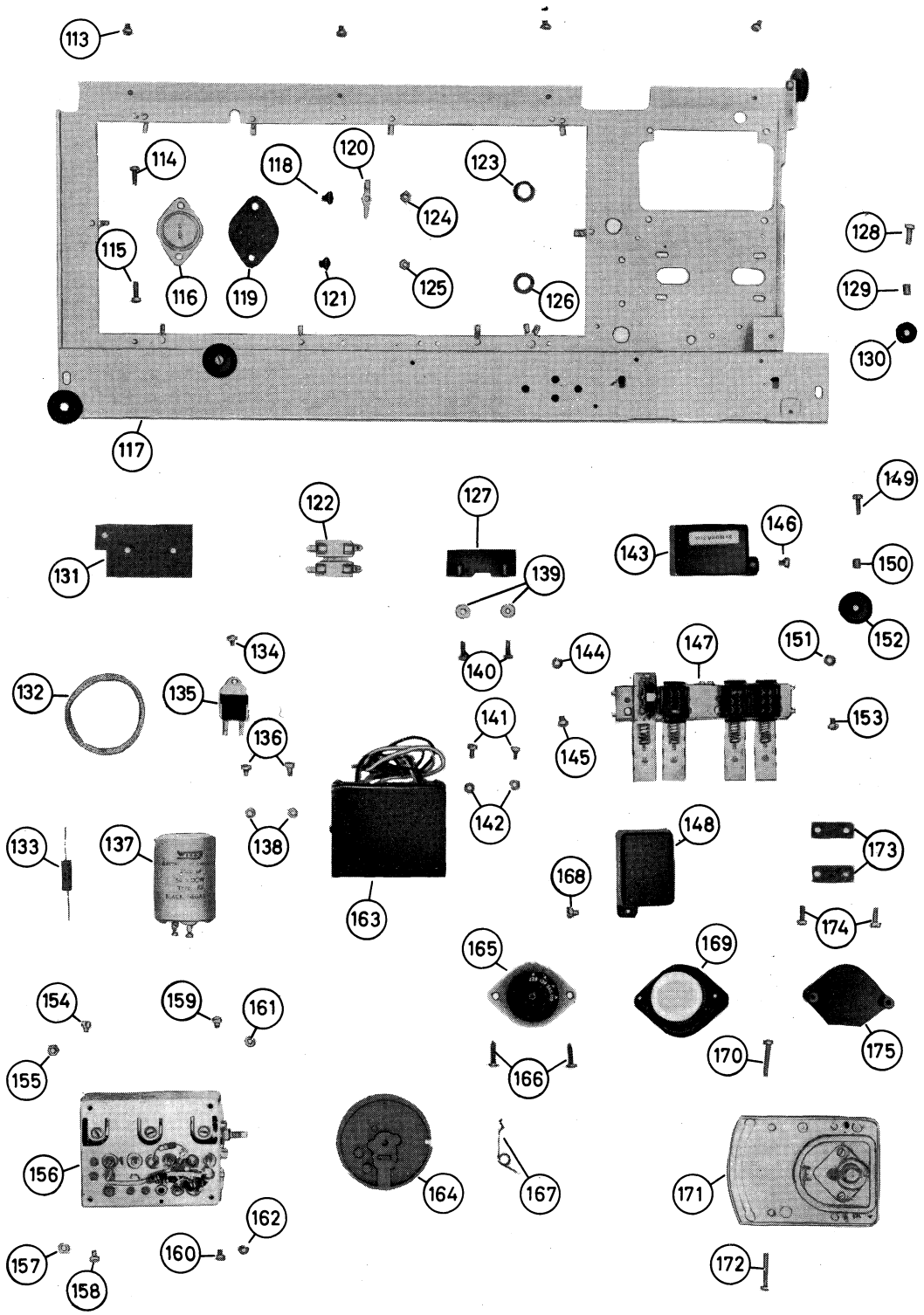
100	Screw, AM 3 x 12 DIN 84	2038220
101	Washer	2622016
102	Screw, AM 3 x 12 DIN 84	2038220
103	Washer	2622016
113	Screw, AM 3 x 4 DIN 84	2038206 - 4 off
114	Screw, AM 3 x 10 DIN 84	2038216
115	Screw, AM 3 x 10 DIN 84	2038216
116	Transistor, AD 149	8320012
	Fibre washers	0376436 - 2 off
117	Chassis	0504330
118	Insulating bushing	2938009
119	Mica insert	3170002
120	Solder tag	7530013
121	Insulating bushing	2938009
122	Fuse holder, double	7202002
	Fuse, 160 mA 250 V	6604026
123	Nylon bushing	2938013
124	Nut, 3 MT	2380011
125	Nut, 3 MT	2380011
126	Nylon bushing	2938013
127	Insulating plate	0530631
128	Screw, AM 3 x 10 DIN 84	2038216
129	Bushing	0410319
130	Cord pulley	2724001
131	Insulating plate	0530632
132	Dial cord	3955008
133	Resistor, 3.3 Ω	5102012
134	Screw, AM 3 x 4 DIN 84	2038206
135	Rectifier, B 30 C 250 C 12	8310014
136	Screws, AM 3 x 6 DIN 84	2038247
137	Electrolytic capacitor	4201033
138	Tooth lock washer	2625002
139	Washer	2622016
140	Screw, ART 4271 - 2.84 x 9.52 mm	2013202
141	Screw, AM 3 x 6 DIN 84	2038247
142	Tooth lock washer	2625002
143	Cover	3300002
144	Tooth lock washer	2635002
145	Screw, AM 3 x 4 DIN 84	2038206
146	Screw, AM 3 x 4 DIN 84	2038206
147	Push button switch assembly	7402022
148	Cover	3300002
149	Screw, AM 3 x 10 DIN 84	2038216
150	Bushing	0410319
151	Tooth lock washer	2625002
152	Cord pulley	2724002
153	Screw, AM 3 x 4 DIN 84	2038206
154	Screw, AM 3 x 4 DIN 84	2038206
155	Tooth lock washer	2625002
156	FM front end	8050019
157	Tooth lock washer	2625002
158	Screw, AM 3 x 4 DIN 84	2038206
159	Screw, AM 3 x 4 DIN 84	2038206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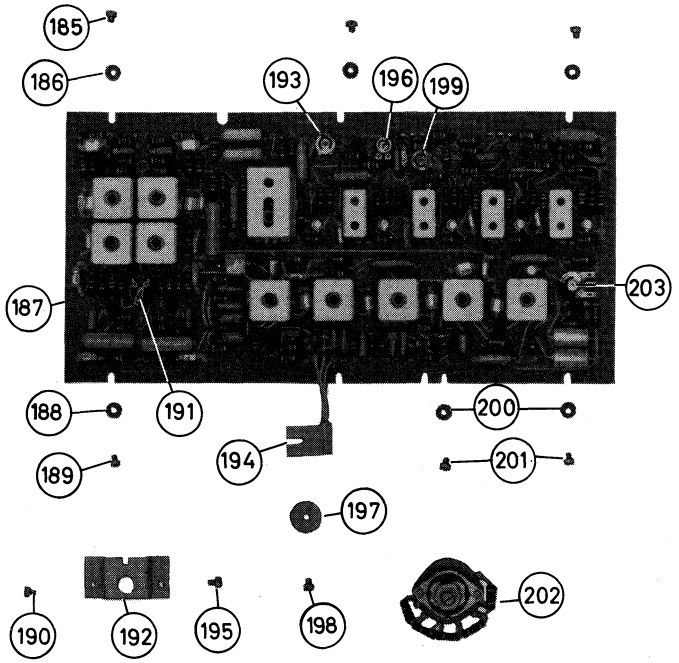
160	Screw, AM 3 x 4 DIN 84	2038206
161	Tooth lock washer	2625002
162	Tooth lock washer	2625002
163	Power transformer	8013043
164	Dial drive wheel	2724006
165	Voltage switch	7401001
166	Screw, ART 4261 - 3.50 x 12.70 mm	2015202
167	Spring	0335149
168	Screw, AM 3 x 4 DIN 84	2038206
169	Screen for voltage switch	3164008
170	Screw, AM 3 x 20 DIN 84	2038233
171	Tuning meter	8450006
172	Screw, AM 3 x 20 DIN 84	2038233
173	Clamp	0287155
174	Screw, AM 3 x 10 DIN 84	2038216
175	Cover for voltage switch	0543106
185	Screw, AM 3 x 4 DIN 84	2038206
186	Fibre washer	0376369
187	PW board, complete	8002013
	Transistor, AC 187	8320060
	- AF 121	8320020
	- BC 113	8320056
	- BC 114	8320057
	- AC 153	8320059
	- AD 149	8320012
	Diode, AA 119	8300024
	- OA 79	8300022
	- SI 9.1 V	8300028
	- SI 12 V	8300029
188	Fibre washer	0376369
189	Screw, AM 3 x 4 DIN 84	2038206
190	Screw, AM 3 x 4 DIN 84	2038206
191	Potentiometer, 5 KΩ	5370036
192	Bracket	0240329
193	Potentiometer, 1 KΩ lin.	5370050
194	Heat sink	3358000
195	Screw, AM 3 x 4 DIN 84	2038206
196	Potentiometer, 1 megohm	5370049
197	Washer	0286135
198	Screw, AM 3 x 4 DIN 84	2038206
199	Potentiometer, 1 KΩ lin.	5370050
200	Fibre washer	0376369
201	Screw, AM 3 x 4 DIN 84	2038206
202	Switch, 2 x 5 positions	7401005
203	Potentiometer, 2.2 KΩ	5370009



Parts not photographed

Mains plug	7221006
Bottom plate	0508189
Screws for bottom plate, AM 3 x 4 DIN 84	2038206
Screws for bottom plate, AM 3 x 12 DIN 84	2038220
Cabinet, top section	0542430
Spring for cabinet, front	0322146
Spring for cabinet, rear	0322145
Screws for springs, 3.5 x 9.5 mm	2015201
Operating instructions	3502024
Bottom diagram	3535004
Station transfers	3180119
Packing, outer cardboard	3391024
Packing, inside cardboard	3391083
Pycofoam (Polystyrene)	3397008

Extra Accessories:

Aerial	7221019
Cable for connection to BEOLAB 5000 and BEOCORD 2000	0961014

Service Tips

The output terminals of spare tuning meters are short circuited before despatch in order to protect the pointer.

The short circuit damps the moving coil and hence also the pointer so that it will not strike hard against the stop in the case of shocks and jolts.

The short circuit should not be removed until the meter is installed.

N O T E S: